STRATIGRAPHY AND EVOLUTION OF QUETZALPETLATL CORONA (V-61), VENUS

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Introduction: We are mapping the V-61 1:5M-scale quadrangle (50°-75° S.; 300°-0° E.) on Venus as part of our ongoing analysis of the geology, stratigraphy [1], history, and origin of major rises and depressions on Venus [1-3]. The most spectacular feature in the area is Quetzalpetlatl Corona, which is about 800 km in diameter and characterized by massive volcanic eruptions [4,5]. We have focused on Quetzalpetlatl in order to (1) establish a detailed stratigraphy of the corona and adjacent regions, (2) distinguish and trace visible episodes of corona evolution, and (3) compare the stratigraphic and temporal position of the very large Quetzalpetlatl corona with the time intervals of evolution of far smaller coronae and corona-like features in the global geotraverse that we mapped at 30° N. latitude [6].

Stratigraphic units and structures at Quetzalpetlatl: There is no evidence for tessera fragments either in the corona core or rim. The oldest visible unit inside Quetzalpetlatl is densely fractured plains (unit pdf) which make up isolated equidimensional and elongated fragments heavily embayed by younger lava plains. Kipukas of unit pdf are arranged in a radial zone which is oriented in a N-S direction and runs radially to the north from the corona center. Outcrops of unit pdf are heavily dissected by numerous short and parallel lineaments, many of which are resolved as fractures. The northern and western portions of the corona rim are made up by a ridge belt that is about 500-600 km long and several tens of kilometers wide. The belt consists of densely packed ridges with morphologically smooth surfaces. Individual ridges of the belt are about 10 km wide and can extend several tens of kilometers in length. Morphologically, the features of the ridge belt appear to be similar to the common ridge belts elsewhere on Venus [2,3]. Locally, material of unit pdf is deformed by the features of the belt and this is evidence that the belt is younger. Quetzalpetlatl is broadly surrounded to the south, west, and north by material of regional plains with wrinkle ridges (unit pwr_1). At the south edge of the western portion of the rim there is evidence for the embayment of the ridge belt by unit pwr_1 plains. This means that the ridge belt formed after unit pdf and before unit pwr_1. In the southern portion of the corona core there is a cluster of small shields. The shields resemble the typical features of shield plains (unit psh), which are abundant outside of Quetzalpetlatl, and could represent kipukas of the unit. However, such a characteristic of the shields is questionable because of the lack of direct contact between the shields and other units older than the youngest plains, and the likelihood that small shields could be present in the central portion of such a large volcanic source region regardless of age. All previous units are deformed by numerous fractures and grabens that make up a broad system of features radiating away from the corona center. The most abundant unit at the corona is lobate plains (unit pl) consisting of a great number of morphologically smooth radar bright and dark flows. Lobate plains almost completely cover up the core area of Quetzalpetlatl, appear to fill a moat attached to the northern and western portions of the rim, and make up a distal skirt of volcanic materials outside the corona.

Discussion: Although there is a significant block of tessera eastward from the corona, there are no tessera fragments inside Quetzalpetlatl. This could be due to complete flooding

of tessera pieces by later volcanic materials in the corona interior. However, both densely fractured plains and tessera appear to have comparable topography and sometimes the tessera appears to have higher relief. This suggests that the separation of tessera from unit pdf simply by flooding appears implausible. Thus, evidence for unit pdf inside the corona and the absence of tessera there suggests that Quetzalpetlatl formed in an area lacking significant amounts of tessera. This makes unit pdf the oldest unit in the corona area.

The first unit which is a significant corona element is the ridge belt. Wrinkle ridges of unit pwr_1 are circumferentially arranged around Quetzalpetlatl. This suggests that the formation of the ridges could be governed by the stress field introduced by the presence of the corona. Regional plains with wrinkle ridges, surrounding the corona, are deformed by the radial system of fractures and grabens, which means that the most prominent extensional features at Quetzalpetlatl were formed after the emplacement of unit pwr_1. The formation of the radial fractures and grabens was followed by massive eruption of the youngest lobate plains. Superposition of individual flows indicates that the formation of unit pl took place during several (or many) eruptive episodes. The vast majority of the radial grabens are flooded by the unit pl material. However, some of the grabens appear to cut through the surface of unit pl.

The above relations of the units and structures permit us to outline a generalized scheme of events in the evolution of Quetzalpetlatl. As Quetzalpetlatl evolved, it experienced at least two main tectonic episodes separated by the emplacement of regional plains with wrinkle ridges. The first, a dominantly compressional regime, was responsible for the formation of the ridge belt in the northwest part of the corona rim. The second episode, an extensional regime, led to the formation of the radial system of fractures and grabens. The last visible activity at the corona was the emplacement of vast deposits of lobate plains. Thus, as is the case with the majority of coronae in the geotraverse, Quetzalpetlatl apparently started to form before the emplacement of regional plains and, in a manner similar to a few coronae in the geotraverse, the evolution of Quetzalpetlatl continued through the long period of time until the formation of lobate plains.

Reference: [1] Ivanov, M.A., and Head, J.W., 1998, Global stratigraphic units on Venus: Results of a geotraverse around the Venus globe at 30 N latitude, LPSC 29; [2] Head, J.W., and Ivanov, M.A., 1996, LPSC 27, 515-516; [3] Basilevsky, A.T., and Head, J.W., 1995, EMP, 66, 285-336; Basilevsky, A.T., and Head, J.W., 1995, PSS, 43, 1523-1553; [4] Stofan, E.R. et al., 1992, JGR, 97, 13347-13378; [5] Roberts, K.M. et al., 1992, JGR, 97, 15991-16016; [6] Ivanov, M.A., and Head, J.W., 1998, Stratigraphy of coronae: Results from the mapping of global 30 N geotraverse, LPSC 29.